

N61165.AR.003415
CNC CHARLESTON
5090.3a

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION WORK
REPORT AND FACILITY ASSESSMENT AREA OF CONCERN 722 (AOC 722) ZONE I CNC
CHARLESTON SC
5/9/2003
CH2M HILL

RCRA FACILITY ASSESSMENT/RCRA FACILITY INVESTIGATION WORK

AOC 722 Zone I



***Charleston Naval Complex
North Charleston, South Carolina***

SUBMITTED TO
***U.S. Navy Southern Division
Naval Facilities Engineering Command***

CH2M-Jones

May 2003

Contract N62467-99-C-0960



CH2MHILL

CH2M HILL

115 Perimeter Center Place, NE

Suite 700

Atlanta, GA 30346-1278

Tel 770.604.9095

Fax 770.604.9282

May 9, 2003

Mr. David Scaturo
Division of Hazardous and Infectious Wastes
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: RCRA Facility Assessment/RCRA Facility Investigation Work Plan (Revision 0) –
AOC 722, Zone I

Dear Mr. Scaturo:

Enclosed please find four copies of the RCRA Facility Assessment/RCRA Facility Investigation Work Plan (Revision 0) for AOC 722 in Zone I of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Bill Elliott. Please contact him at 352/335-5877, extension 2477, should you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

RCRA FACILITY ASSESSMENT/RCRA FACILITY INVESTIGATION WORK PLAN

AOC 722, Zone I



***Charleston Naval Complex
North Charleston, South Carolina***

SUBMITTED TO
***U.S. Navy Southern Division
Naval Facilities Engineering Command***

PREPARED BY
CH2M-Jones

May 2003

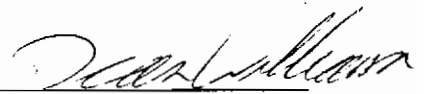
*Revision 0
Contract N62467-99-C-0960
158814.ZI.PR.14*

**Certification Page for RFA/RFI Work Plan (Revision 0) –
AOC 722, Zone I**

I, Dean Williamson, certify that this report has been prepared under my direct supervision.
The data and information are, to the best of my knowledge, accurate and correct, and the
report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428



Dean Williamson, P.E.



Date

Contents

Section	Page
Acronyms and Abbreviations	vi
1.0 Introduction.....	1-1
2.0 Unit Characteristics.....	2-1
2.1 Facility Description	2-1
2.2 Facility Operations	2-1
2.3 Waste Characteristics	2-2
2.4 Migration Pathways and Exposure Potential.....	2-2
2.5 Recommended Action	2-3
Figure 2-1 Location of AOC 722 within Zone I of the CNC	2-4
Figure 2-2 Site Map	2-5
3.0 RFI Work Plan for AOC 722	3-1
3.1 Purpose and Objectives	3-1
3.2 General Requirements	3-1
3.2.1 Data Quality Assurance Requirements	3-1
3.2.2 Data Management Requirements.....	3-1
3.2.3 Reporting Requirements.....	3-2
3.2.4 Health and Safety Requirements.....	3-2
3.2.5 Sampling Methodology	3-2
3.2.6 Investigation-Derived Waste (IDW) Management and Disposal.....	3-3
3.2.7 Sample Handling and Chain of Custody	3-3
3.2.8 Analysis of Samples	3-3
3.3 Proposed Sampling and Analysis	3-4
3.3.1 Soil Sampling	3-4
3.3.2 Proposed Groundwater Sampling	3-4
3.3.3 SCDHEC Well Installation Request.....	3-6
3.3.4 Data Analysis and Screening	3-7
3.3.5 Project Schedule.....	3-7

1 **Contents, Continued**

2	Table 3-1	VOCs Detected in Groundwater	3-8
3	Table 3-2	Sampling and Analytical Parameters	3-11
4	Figure 3-1	Proposed Soil Sampling Locations.....	3-12
5	Figure 3-2	Monitoring Well and DPT Sampling Locations.....	3-13
6	Figure 3-3	VOC Detections in Groundwater	3-14
7	Figure 3-4	Shallow Aquifer potentiometric Surface Map.....	3-15
8	Figure 3-5	Proposed Groundwater Sampling Locations	3-16
9	4.0	References	4-1

10

11 **Appendices**

12	A	Analytical Results for 2002 Groundwater Sampling Event
----	----------	---

1 Acronyms and Abbreviations

2	cis-1,2-DCE	cis-1,2-dichloroethylene
3	trans-1,2-DCE	trans-1,2-dichloroethene
4	AOC	area of concern
5	BCT	BRAC Cleanup Team
6	bls	below land surface
7	BOQ	Bachelor Officers' Quarters
8	BRAC	Base Realignment and Closure Act
9	BTEX	benzene, ethylbenzene, toluene, and xylene
10	CA	corrective action
11	CNC	Charleston Naval Complex
12	COC	chemical of concern
13	COPC	chemical of potential concern
14	CSAP	Comprehensive Sampling and Analysis Plan
15	DQO	data quality objectives
16	DPT	direct push technology
17	EBS	Environmental Baseline Survey
18	EDD	electronic data deliverable
19	EnSafe	EnSafe Inc.
20	EPA	U.S. Environmental Protection Agency
21	ESDSOPQAM	EPA Environmental Services Division <i>Standard Operating</i>
22		<i>Procedures and Quality Assurance Manual</i>
23	ESDLOQCM	EPA Environmental Services Division <i>Laboratory Operations and</i>
24		<i>Quality Control Manual</i>
25	ft bls	feet below land surface
26	IDW	investigation-derived waste
27	µg/L	micrograms per liter
28	NAVBASE	Naval Base

1 **Acronyms and Abbreviations, Continued**

2	OSWER	Office of Solid Waste and Emergency Response
3	OWS	oil/water separator
4	PCB	polychlorinated biphenyl
5	PCE	tetrachloroethene
6	PPE	personal protective equipment
7	QA/QC	quality assurance/quality control
8	RCRA	Resource Conservation and Recovery Act
9	RFA	RCRA Facility Assessment
10	RFI	RCRA Facility Investigation
11	SCDHEC	South Carolina Department of Health and Environmental Control
12	SCE&G	South Carolina Electric and Gas Company
13	SOP	standard operating procedure
14	TCE	trichloroethene
15	UST	underground storage tank
16	VOC	volatile organic compound

Section 1.0

1.0 Introduction

In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates closure and transition of property to the community. The Charleston Naval Complex (CNC) was formed as a result of the dis-establishment of the Charleston Naval Shipyard and NAVBASE on April 1, 1996.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA), with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560). In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC.

The Navy conducted a RCRA Facility Investigation (RFI) in 1998 for Zone I of the CNC. Building 1875, which comprises Area of Concern (AOC) 722, is located in Zone I. At the time of the Zone I RFI, AOC 722 had not been identified as an AOC. During the RFI, a background monitoring well (IGDIGW011) was installed approximately 100 feet south of Building 1875 to evaluate groundwater quality at locations in Zone I presumably unaffected by U.S. Navy activities.

Results of groundwater sample analysis from this well indicated the presence of several volatile organic compounds (VOCs), including trichloroethylene (TCE). Additional groundwater assessment activities identified Building 1875 as a likely area of origin for the groundwater contamination. As a result, this area was designated as an AOC requiring RCRA action in the form of this RCRA Facility Assessment (RFA).

2.0 Unit Characteristics

2.1 Facility Description

AOC 722 is comprised of Building 1875, which is located directly west of Building 0028, the former Bachelor Officers' Quarters (BOQ). The AOC is located in Zone I of the CNC, approximately 400 feet north of the intersection of Partridge and Thompson Avenues (see Figure 2-1). Building 1875 is a one-story concrete block structure of approximately 4,136 square feet that was built in 1981 to serve as a storage and supply warehouse for the BOQ in Building 0028. Building 0028 is a three-story structure with three wings, constructed in three phases between 1958 and 1971. Figure 2-2 shows an aerial photograph of the site layout.

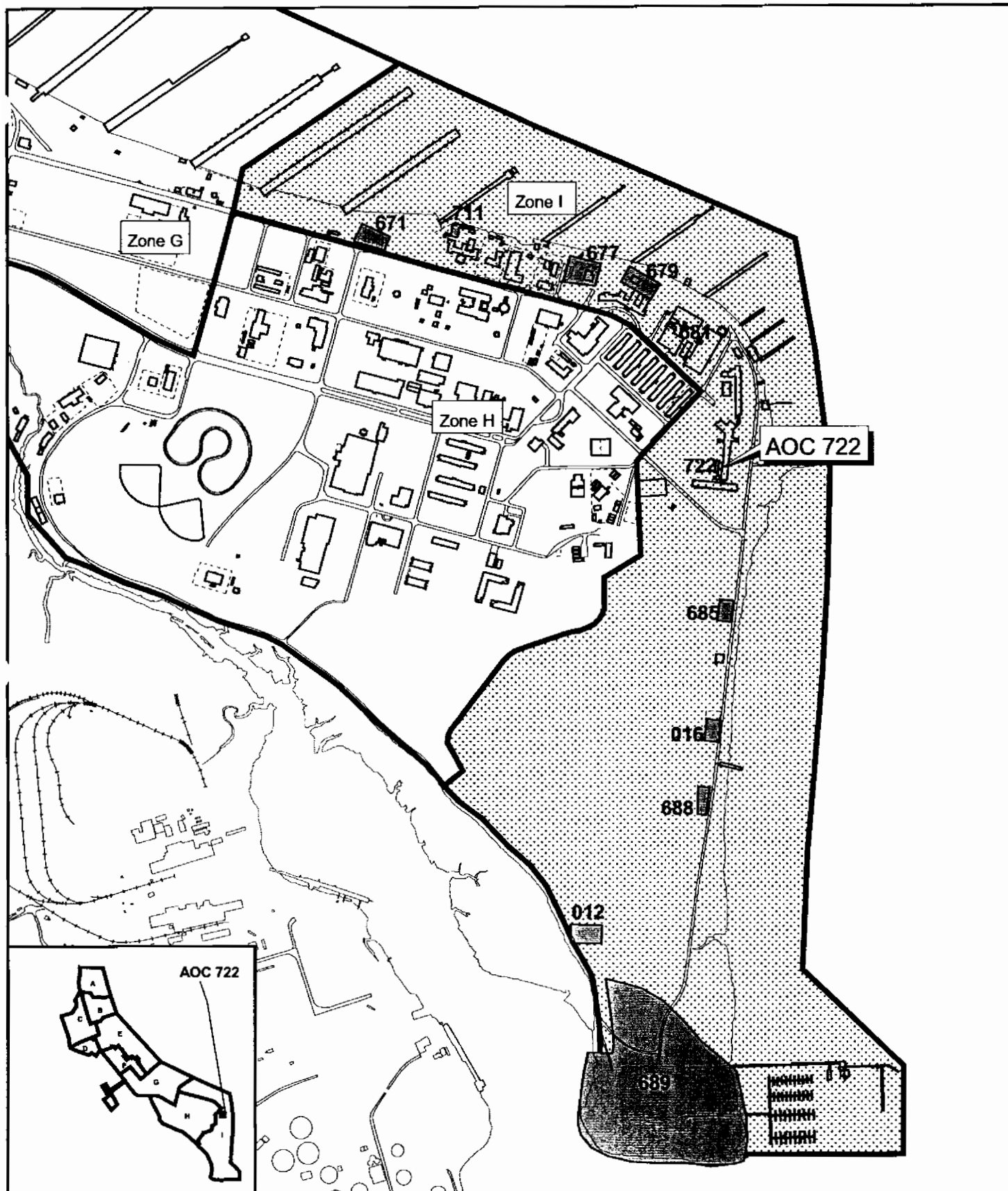
The areas north, east, and south of the Building 1875 are grassed. The area west of the building is a gravel parking lot. The topography of the site is relatively flat. The Cooper River lies approximately 400 feet to the east.

Building 0028 is now occupied by the U.S. Border Patrol. Facility 1795 lies directly south of AOC 722 and consists of a small concrete pad-mounted electrical transformer operated by SCE&G. The transformer is secured by a brick fence.

No underground storage tanks (USTs), boilers, sewer systems, septic systems, or oil/water separators (OWSs) are associated with Building 1875. Fuel USTs were formerly located next door at Building 0028, but were successfully removed in 2000. According to available information, no wetlands are associated with this facility. The building lies within the 100-year floodplain. The AOC 722 area is currently zoned as B-2, for business use.

2.2 Facility Operations

From the construction date until base closure in 1995, Building 1875 was used as a supply warehouse for storage. At some point after the Navy ceased operations at the CNC, Omni Club began using the facility as a maintenance shop, repairing primarily electrical appliances, and to store basic maintenance supplies, including spray paints, cleaners, solvents, and abrasives. The appliance repair activities, including welding, painting, and



 Zone I Boundary
 SWMU/AOC Within Zone I Boundary



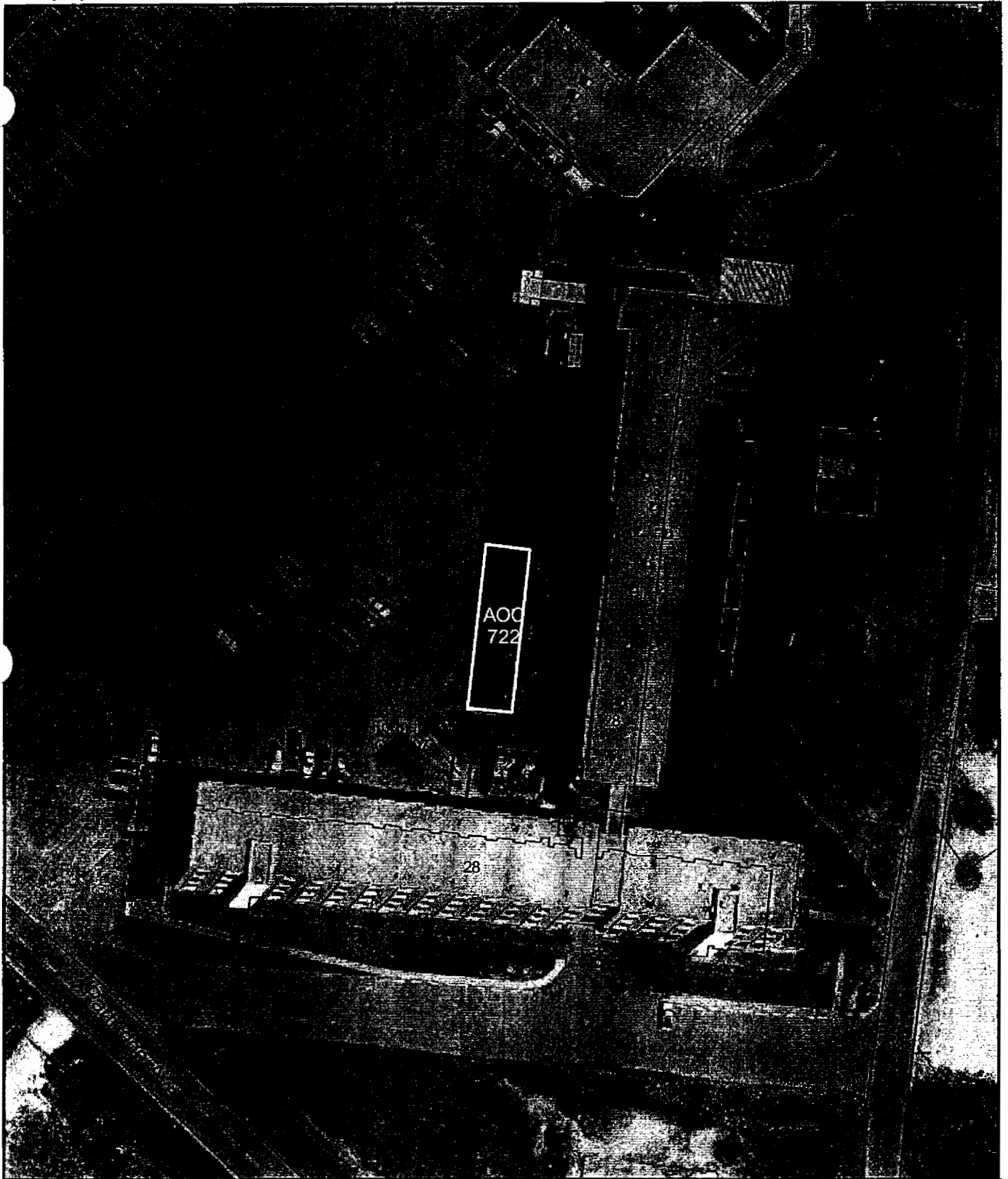
0 800 1600 Feet





1 inch = 1000 feet

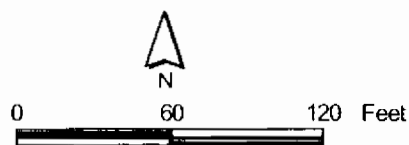
Figure 2-1
 Location of AOC 722 Within Zone I
 AOC 722, Zone I
 Charleston Naval Complex

CH2MHILL

NOTE: Aerial Photo Date is 1997
NOTE: Original figure created in color



-  Roads
-  AOC Boundary
-  NFA AOC Boundary
-  Buildings



1 inch = 75 feet

Figure 2-2
Site Map
AOC 722, Zone I
Charleston Naval Complex

CH2MHILL

Section 3.0

3.0 RFI Work Plan for AOC 722

3.1 Purpose and Objectives

This RFI Work Plan is intended to determine the nature and extent of any releases of hazardous wastes or constituents from the vicinity of Building 1875. Delineation of the nature and extent of contamination in soil and groundwater is necessary to complete the RFI. General requirements for the work plan are presented first, followed by specific soil and groundwater sampling recommendations.

3.2 General Requirements

3.2.1 Data Quality Assurance Requirements

The field work and laboratory work conducted as part of the AOC 722 RFI will be performed in accordance with the requirements of the CNC Comprehensive Sampling and Analysis Plan (CSAP) (EnSafe Inc. [EnSafe], 1996) and the U.S. Environmental Protection Agency (EPA) Environmental Services Division *Standard Operating Procedures and Quality Assurance Manual* (ESDSOPQAM, 1996).

The overall data quality objectives for the RFI are EPA Data Quality Objective (DQO) Level III for contaminant identification and quantification. Required field and laboratory quality assurance/quality control (QA/QC) samples will be collected as required by the CSAP. Subcontractor data will be validated by the CH2M-Jones project chemist prior to final interpretation and submittal.

3.2.2 Data Management Requirements

The RFI field data documentation procedures and laboratory data deliverables will be in accordance with the approved CSAP (EnSafe, 1996) and the ESDSOPQAM (EPA, 1996). Field documentation includes site photographs, field sampling logbooks, sample shipping chain of custody forms, soil boring logs, well construction forms and diagrams. Lab documentation includes raw data, instrument calibration logs, sample custody forms, validation summary reports, and final data deliverables.

3.2.3 Reporting Requirements

After completion of the field work, the laboratory analysis of samples, and the screening of analytical results, CH2M-Jones will submit a Revision 0 RFI Report to the BRAC Cleanup Team (BCT) for review and comment. BCT comments will be addressed in writing, and revised document pages or a full Revision 1 document will be prepared and submitted for review. Reports will be submitted in both electronic and hard copy format.

3.2.4 Health and Safety Requirements

CH2M-Jones places significant emphasis on the health and safety of our personnel, subcontractors, and the local community. All field work completed as part of this RFI will be performed in accordance with the CH2M-Jones Site-Specific Health and Safety Plan (CH2M-Jones, 2000). Personnel working at the site will be required to comply with EPA Level D personal protective equipment (PPE) requirements, as specified in the Health and Safety Plan. Once all personnel have arrived at the site as part of the mobilization for this RFI, a project briefing and health and safety orientation meeting will be held. Daily "tailgate" safety meetings will be conducted to address any site-specific issue encountered during work.

3.2.5 Sampling Methodology

Soil sampling and monitoring well installation locations will be marked or staked in the field prior to the initiation of field work, and the necessary agencies and departments will be notified regarding activities planned at these locations. Clearance and marking of existing underground water, natural gas, telephone, electrical and other utility lines, which are potential hazards at the site. Once utilities are marked and identified, sampling locations will be adjusted as needed.

The soil sample collection and equipment decontamination procedures will conform to the procedures described in the CSAP portion of the CNC RFI Work Plan (EnSafe/Allen & Hoshall, 1994). Surface and subsurface soil samples will be collected using a hand auger or Geoprobe rig with Macrocore sampler, or equivalent, with samples being collected for chemical analysis. The sampling will consist of soil borings with a surface (0-1 foot below land surface [bls]) sample and a subsurface (3-5 feet bls) sample collected from each boring

at each proposed location. For samples beneath asphalt pavement, a small section of payment will be carefully cut out prior to sampling.

Upon completion of sampling, soil borings will be filled to the land surface with bentonite grout, in accordance with Rule 61-71.10.B of the South Carolina Well Standards and Regulations. Soil boring and well locations will be marked with the station I.D. for the survey team to establish horizontal location coordinates (and vertical elevations relative to mean sea level [msl] for monitoring wells).

3.2.6 Investigation-Derived Waste (IDW) Management and Disposal

Investigation-derived waste (IDW) expected to be generated as part of this investigation include pavement debris, soil cuttings, well purge water, equipment decontamination wastes, and used personal protective equipment (PPE). As it is generated, IDW will be containerized in labeled 55-gallon drums and characterized in accordance with South Carolina Hazardous Waste Management Regulations (SCDHEC R.61-79.261). Filled containers will be transported to the less than 90-day storage facility located at Building 1824. After analytical results have been received and reviewed, the containers will be transported to a permitted and licensed facility for proper treatment/disposal.

3.2.7 Sample Handling and Chain of Custody

Sample collection procedures and site conditions at the time of sampling will be documented in a field logbook by the field team leader. Samples will be collected in prepared containers supplied by the lab vendor, using preprinted chain of custody logsheets and coolers for transport of the samples. Samples will be iced as appropriate and transported by the sampling team to the lab for analysis, maintaining the chain of custody at all times after sampling occurs until analysis is complete. Sample handling procedures will adhere to the standard procedures in the approved CSAP portion of the CNC RFI Work Plan (EnSafe/Allen & Hoshall, 1994).

3.2.8 Analysis of Samples

Samples will be delivered to a subcontracted laboratory for chemical analysis by EPA methods and/or standard operating procedures (SOP) for screening methods to achieve Level II EPA DQOs. The subcontracted lab will meet the EPA DQO Level II criteria specified

in the approved CNC CSAP (EnSafe, 1996). Sample analysis will be performed in accordance with the guidance in EPA's *Test Methods for Evaluating Solid Waste, SW-846, Revision 4* (1996b), Office of Solid Waste and Emergency Response (OSWER) and in the EPA Environmental Services Division *Laboratory Operations and Quality Control Manual* (ESDLOQCM) (1997).

3.3 Proposed Sampling and Analysis

3.3.1 Soil Sampling

There are no known releases of hazardous substances to the environment at AOC 722, and no documentation of visual evidence of contamination during any of the site inspections or previous field work. Because Building 1875 was previously used as a supply/storage warehouse, and because the highest levels of VOCs in groundwater occur adjacent to this building, a series of six soil borings will be installed around the perimeter of Building 1875, with three of the borings located in the ditch between Buildings 0028 and 1875. Both a surface soil (0 to 1 feet below land surface [ft bls]) and a subsurface (3 to 5 ft bls) soil sample will be collected at each location, as site conditions allow. If groundwater is encountered closer than 5 ft bls, the subsurface borings will be collected slightly shallower, within 2 feet above the top of the groundwater in the vadose zone. The proposed RFI soil sampling locations for AOC 722 are presented in Figure 3-1.

All soil samples will be analyzed for VOCs, SVOCs, RCRA metals, pesticides, and polychlorinated biphenyls (PCBs).

Surface and subsurface soil samples will also be collected at two locations on the south side of Facility 1795 and two locations south of Building 0028 because of the occurrence of dichlorobenzenes in groundwater downgradient of Building 0028. These samples will be analyzed for PCBs and VOCs.

3.3.2 Proposed Groundwater Sampling

Previous Groundwater Investigations

During the Zone I RFI, the Navy installed two background grid wells south of Building 0028, designated IGDIGW011 and IGDIGW11D in order to characterize background

1 groundwater conditions in Zone I (see Figure 3-2 for monitoring well locations). VOCs were
2 detected in shallow grid well IGDIGW011 shortly after installation in 1996 and confirmed
3 by repeated sampling during 1998. In 1998, the Navy collected additional groundwater
4 samples from a series of five temporary direct push technology (DPT) samplers installed
5 around Building 0028, designated IGDIGP001 through IGDIGP005. These DPT locations
6 were intended to screen groundwater near grid well IGDIGW011. VOCs were not detected
7 in these DPT samples in 1998.

8 Because VOCs had been detected in Zone I shallow aquifer grid well IGDIGW011 during
9 the Zone I RFI, CH2M-Jones implemented a preliminary groundwater investigation in 2002
10 under guidance from SCDHEC. CH2M-Jones installed three DPT temporary groundwater
11 samplers around Buildings. 0028 and 1875 in May 2002. Permanent monitoring wells
12 IG11GW001 through IG11GW005 were installed in February and May 2002. Monitoring well
13 and DPT sampling locations are shown on Figure 3-2.

14 A summary of VOC detections in groundwater is presented in Figure 3-3. Table 3-1 also
15 summarizes detected VOCs. The results show that TCE is the most commonly detected
16 VOC, detected in all five monitoring wells installed by CH2M-Jones, with a maximum
17 concentration of 72.5 micrograms per liter ($\mu\text{g}/\text{L}$) in well IG11GW005. TCE has also been
18 consistently detected in shallow grid well IGDIGW011. The fuel constituents benzene,
19 ethylbenzene, toluene and xylenes (BTEX) were also detected at low concentrations; the
20 occurrence of these chemicals may be associated with the two USTs recently removed from
21 service. The occurrence of dichlorobenzenes appears to be limited to permanent monitoring
22 wells IG11GW001, IG11GW002, and IG11GW003 on the south side of Building 0028. No
23 clear originating point for the dissolved VOC constituent plume can be discerned, but
24 concentrations do appear to be decreasing toward the south, which is hydraulically
25 downgradient. Figure 3-4 presents shallow aquifer hydraulic gradients, as measured in
26 March 2002. The complete analytical results for the 2002 CH2M-Jones groundwater
27 sampling event are presented in Appendix A.

28 Three additional shallow monitoring wells will be installed to address the lateral extent of
29 VOCs in groundwater. One well will be installed to the east of existing well IG11GW005 to
30 determine lateral plume extent. This well will be located in the grassy area on the east side

1 of Building 0028 to better refine hydraulic gradients and direction of shallow groundwater
2 flow.

3 The second new monitoring well, designated I722GW002, will be installed approximately 60
4 feet west of the southwest corner of Building 1875 to assess lateral VOC plume extent and
5 better refine hydraulic gradients and direction of shallow groundwater flow. The third new
6 monitoring well, designated I722GW003, will be installed to assess the downgradient plume
7 extent of VOCs southeast of existing well IG11GW002.

8 Figure 3-5 shows the proposed locations of the three new monitoring wells.

9 The wells will be installed into the shallow aquifer at the water table, which occurs at depths
10 of approximately 2 to 4 ft bls. The wells will be constructed with 10 foot screens to match the
11 existing wells, with a total completed depth of approximately 12 to 15 ft bls. The new wells
12 will be developed after installation and allowed to equilibrate prior to beginning
13 groundwater sampling. After development, the three new wells, the three existing shallow
14 monitoring wells, and the two existing grid wells will be sampled, with samples analyzed
15 for VOCs.

16 A state of South Carolina certified well driller will be utilized for monitoring well
17 installation on this project. The driller will be supervised by a CH2M-Jones field
18 hydrogeologist or engineer who will be responsible for the conduct of all field activities. Soil
19 boring/well construction logs will be prepared to document the geologic units encountered
20 and the details of well construction for submittal to SCDHEC. A summary of the proposed
21 soil and groundwater sampling locations, chemical analysis scope, and analytical methods
22 is presented in Table 3-2.

23 **3.3.3 SCDHEC Well Installation Request**

24 In accordance with Rule R.61-79.265, Subpart F of the South Carolina Hazardous Waste
25 Management Regulations and R.61-71 of the South Carolina Well Standards and
26 Regulations, a request for the advancement of the monitoring well/soil borings is required
27 to be submitted to SCDHEC two weeks prior to the scheduled activity. The written request
28 describes the purpose of the boring/well installation activity at AOC 722, and presents well

1 construction details, a map showing the proposed locations, and proposed abandonment
2 techniques, as appropriate.

3 **3.3.4 Data Analysis and Screening**

4 Initial screening of analytical results will be conducted as soon as final unvalidated results
5 are available from the lab to determine which chemicals may be indicated as chemicals of
6 potential concern (COPCs) and which media and locations may be affected. After data
7 validation is completed, flagged/corrected results will then be electronically downloaded
8 into a screening database to determine COPCs for each affected media, using current
9 screening criteria.

10 A full evaluation and presentation of COPC screening against current criteria, as well as the
11 COPC/chemical of concern (COC) refinement analysis, will be presented in an RFI Report
12 after completion of the sampling and analysis proposed herein and any additional phases of
13 sampling required to adequately delineate the nature and extent of contamination.

14 **3.3.5 Project Schedule**

15 The field work for this site is scheduled to be conducted in June 2003, with a duration of
16 approximately 1 week. The laboratory turnaround schedule for producing data reports is
17 expected to be approximately 4 to 6 weeks from time of sampling. Data quality review,
18 flagging of data, and data validation are expected to require approximately 2 weeks after
19 receipt of the electronic data deliverable (EDD) from the lab. Data analysis and report
20 preparation are expected to require approximately 30 days after receipt of final validated
21 data, placing an approximate report submittal date in August 2003.

TABLE 3-1

VOCs Detected in Groundwater

RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 722, Zone I, CNC

Sample Location	Analyte	Concentration (µg/L)	Qualifier	Date Collected
IG11GP001	1,2-Dichloroethene (total)	1.20	J	05/23/2002
	Benzene	0.42	J	
	Bromodichloromethane	0.42	J	
	Carbon Disulfide	3.20	J	
	Chloroform	0.41	J	
	cis-1,2-Dichloroethylene	1.20	J	
	Dibromochloromethane	0.41	J	
IG11GP002	1,2-Dichloroethene (total)	1.20	J	
	Benzene	0.40	J	
	Carbon Disulfide	3.10	J	
	Chloroform	0.41	J	
	cis-1,2-Dichloroethylene	1.20	J	
	Dibromochloromethane	0.40	J	
IG11GP003	1,2-Dichloroethane	1.80	J	
	1,2-Dichloroethene (total)	7.90	=	
	Carbon Disulfide	2.90	J	
	cis-1,2-Dichloroethylene	6.00	=	
	Ethylbenzene	0.71	J	
	Trichloroethylene (TCE)	25.20	=	
	Toluene	0.52	J	
	trans-1,2-Dichloroethene	1.90	J	
IGDIGP002	Methylene Chloride	8.00	=	01/28/1998
IGDIGP005	Acetone	4.00	J	
	Carbon Disulfide	1.00	J	
IG11GW001	1,2-Dichlorobenzene	11.60	=	02/22/2002
	1,3-Dichlorobenzene	0.60	J	
	Chlorobenzene	6.00	=	
	Trichloroethylene (TCE)	1.40	J	
	Toluene	0.26	J	
IG11GW002	1,2-Dichlorobenzene	31.40	=	
	1,3-Dichlorobenzene	1.20	J	
	1,4-Dichlorobenzene	2.90	J	
	Benzene	1.30	J	
	Chlorobenzene	22.00	=	

TABLE 3-1

VOCs Detected in Groundwater

RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 722, Zone I, CNC

Sample Location	Analyte	Concentration (µg/L)	Qualifier	Date Collected
IG11GW003	Trichloroethylene (TCE)	3.00	J	05/23/2002
	Toluene	0.35	J	
	1,2-Dichlorobenzene	3.80	J	
	1,2-Dichloroethene (total)	0.56	J	
	2-Hexanone	9.20	J	
	Carbon Disulfide	23.00	J	
	Chlorobenzene	2.40	J	
	cis-1,2-Dichloroethylene	0.56	J	
	Methyl ethyl ketone (2-Butanone)	3.00	J	
IG11GW004	Trichloroethylene (TCE)	0.62	J	05/23/2002
	Bromodichloromethane	4.70	J	
	Bromoform	2.40	J	
	Chloroform	3.00	J	
	Dibromochloromethane	5.40	J	
IG11GW005	Trichloroethylene (TCE)	0.62	J	05/23/2002
	1,2-Dichloroethene (total)	18.40	=	
	Benzene	8.40	=	
	Carbon Disulfide	9.10	=	
	cis-1,2-Dichloroethylene	16.30	=	
	Ethylbenzene	1.70	J	
	o-Xylene	2.40	J	
	Trichloroethylene (TCE)	72.50	=	
	trans-1,2-Dichloroethene	2.10	J	
	m+p Xylene	1.80	J	
IGDIGW011	Xylenes, Total	4.20	J	02/22/2002
	1,1-Dichloroethane	0.51	J	
		1.00	J	
		2.00	J	
	1,2-Dichloroethene (total)	3.20	J	
		4.00	J	
		5.00	=	
		7.00	=	
		2.00	J	
	1,2-Dichloropropane	0.30	J	

TABLE 3-1

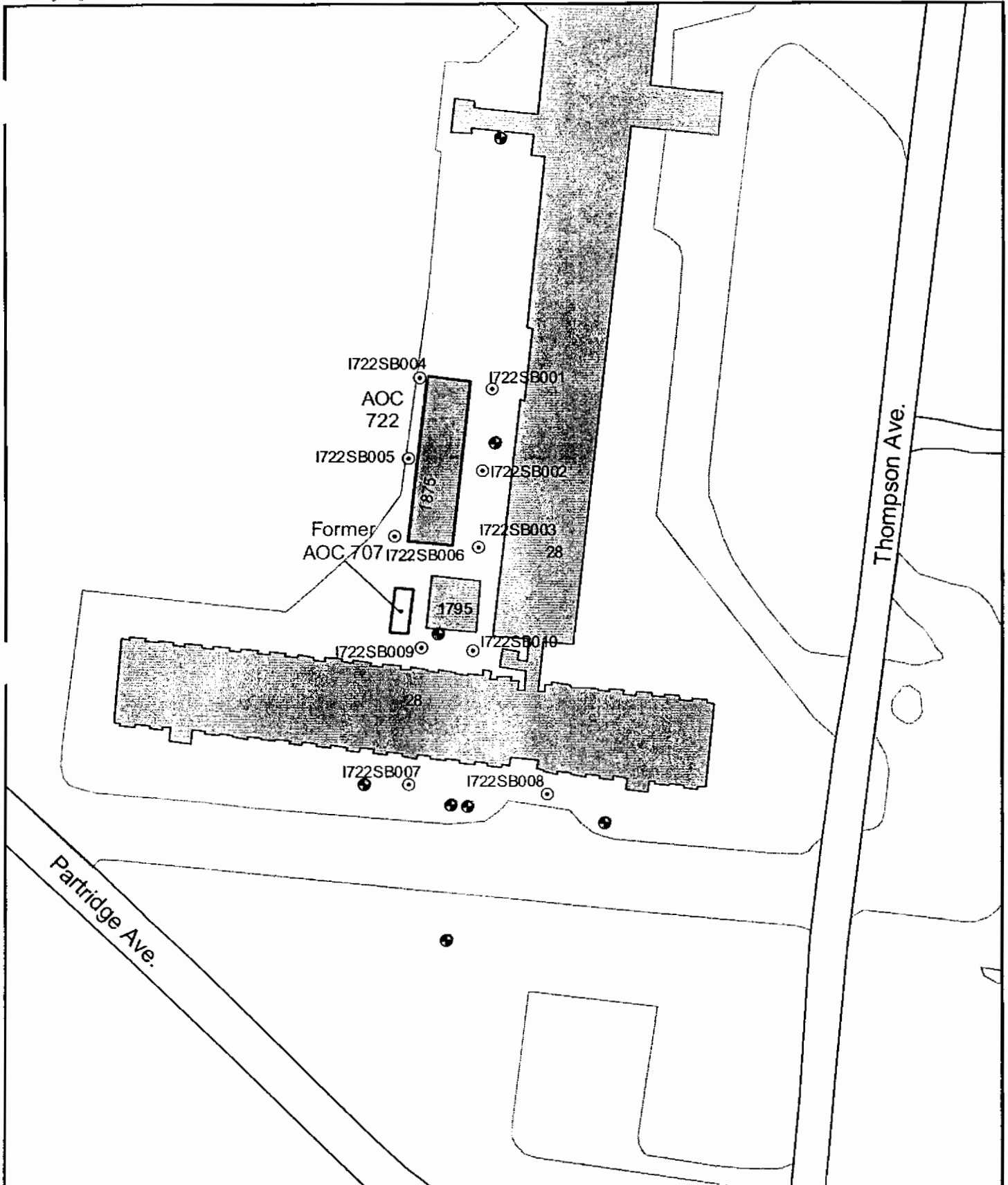
VOCs Detected in Groundwater

RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 722, Zone I, CNC

Sample Location	Analyte	Concentration (µg/L)	Qualifier	Date Collected
IGDIGW11D	Carbon Disulfide	66.60	J	02/22/2002
		2.00	J	05/23/1996
		9.00	J	05/19/1995
	cis-1,2-Dichloroethylene	2.20	J	02/22/2002
	Ethylbenzene	0.26	J	02/22/2002
	Tetrachloroethylene (PCE)	4.00	J	08/29/1996
		1.00	J	12/14/1995
		4.00	J	05/19/1995
	Trichloroethylene (TCE)	2.10	J	02/22/2002
		12.00	=	08/29/1996
		10.00	=	05/23/1996
		4.00	J	12/14/1995
		6.00	=	05/19/1995
	Toluene	0.24	J	02/22/2002
		2.00	J	12/14/1995
	trans-1,2-Dichloroethene	0.96	J	02/22/2002
	Vinyl Chloride	0.74	J	02/22/2002
	Carbon Disulfide	24.70	J	02/22/2002

TABLE 3-2
 Sampling and Analytical Parameters
 RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 722, Zone I, CNC

Station ID Soil	Survey Coordinates			Analytical Methods
	Easting	Northing	Analytes	
I722SB001	2,326,662	369,852	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB002	2,326,656	369,806	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB003	2,326,654	369,763	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB004	2,326,621	369,858	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB005	2,326,615	369,813	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB006	2,326,607	369,769	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB007	2,326,615	369,629	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB008	2,326,693	369,624	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB009	2,326,622	369,706	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
I722SB010	2,326,651	369,704	VOC, SVOC, PCB, RCRA metals, pesticides	SW 846 - 8260B, 8270C, 8082, 6010A/ 7471A, 8081A
Groundwater				
I722GW001	2,326,812	369,758	VOC	SW 846 - 8260B
I722GW002	2,326,529	369,827	VOC	SW 846 - 8260B
I722GW003	2,326,778	369,441	VOC	SW 846 - 8260B



- Monitoring Well
- ⊙ Proposed Soil Boring

- ▬ Roads
- ▬ Pavement
- ▬ Shoreline
- ▭ AOC Boundary
- ▭ NFA AOC Boundary
- ▭ Buildings

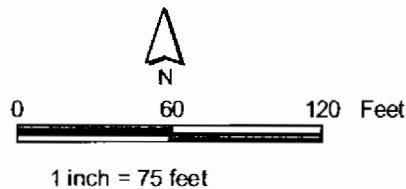
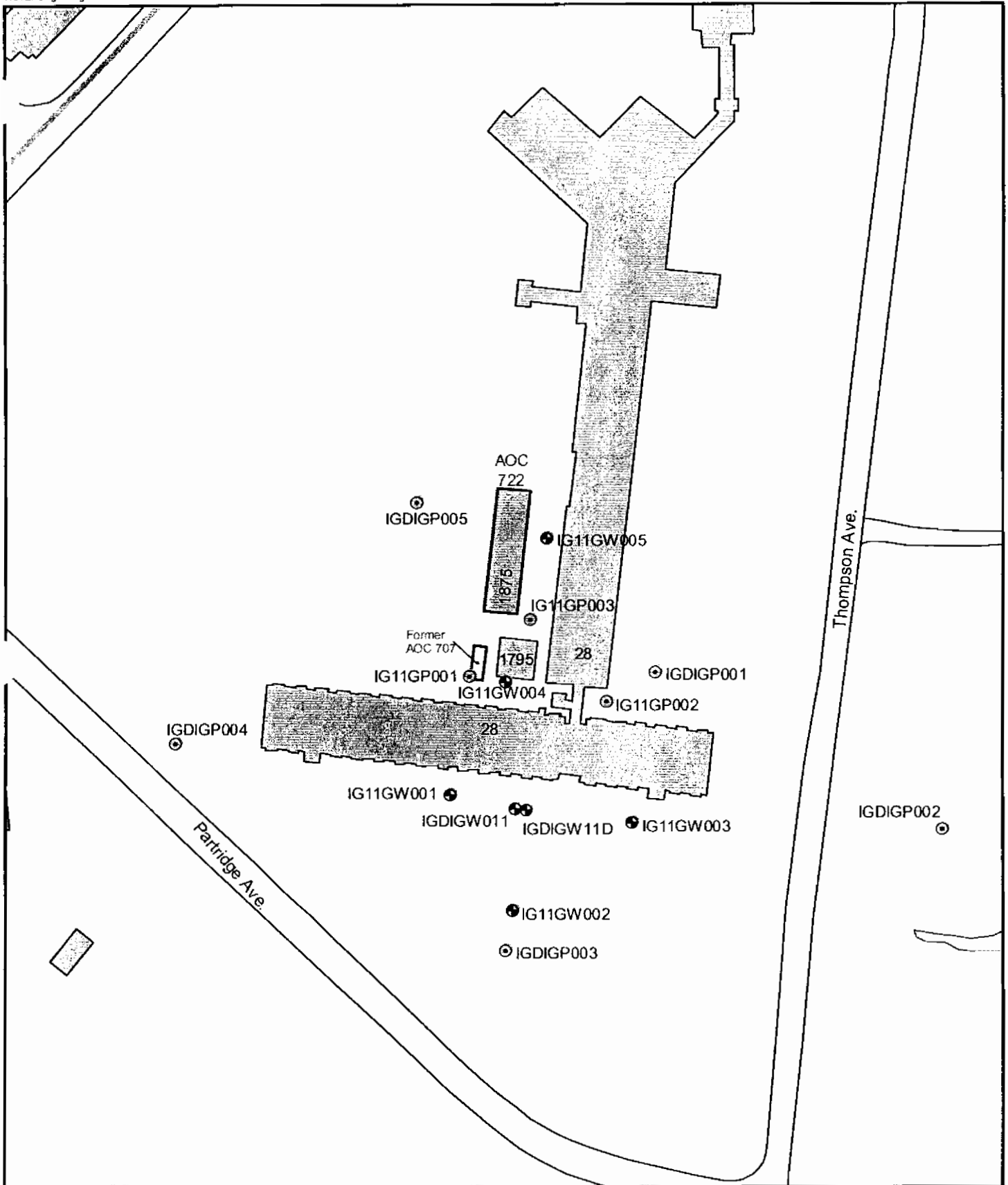


Figure 3-1
Proposed Soil Sampling Locations
AOC 722, Zone I
Charleston Naval Complex

CH2MHILL

NOTE: Original figure created in color



- ⊕ Monitoring Well
- ⊙ Background Well
- ⊗ Geoprobe Location
- ⊙ RFI Geoprobe Location
- Roads
- Shoreline

- AOC Boundary
- NFA AOC Boundary
- ▒ Buildings
- ▒ Zone Boundary

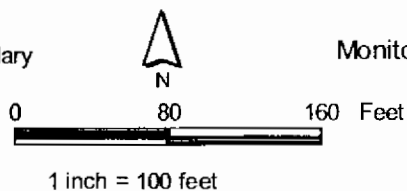
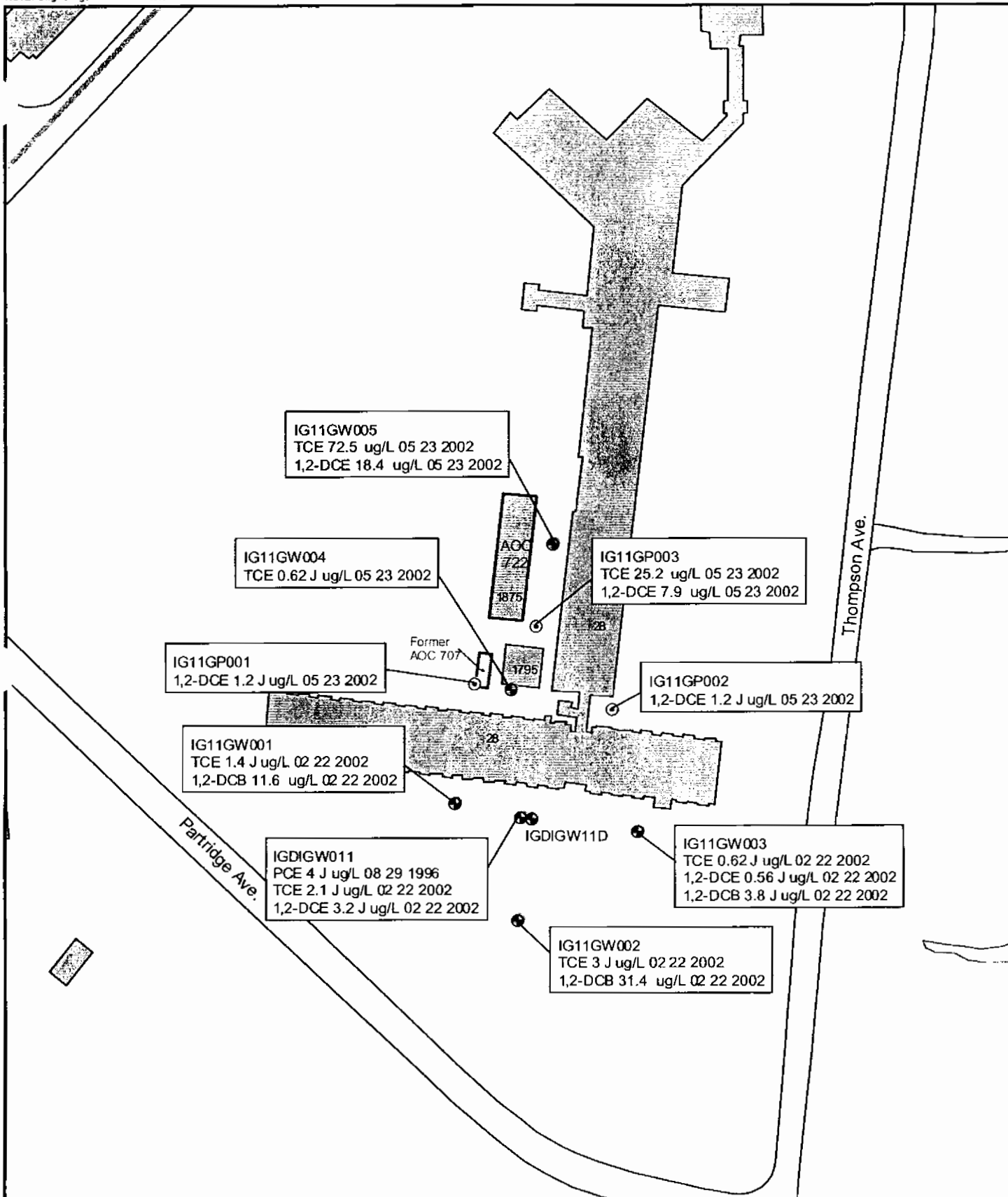


Figure 3-2
Monitoring Well and DPT Sampling Locations
AOC 722, Zone I
Charleston Naval Complex

CH2MHILL

NOTE: Original figure created in color



- Monitoring Wells
- ⊙ Geoprobe
- Roads
- Shoreline
- AOC Boundary
- NFA AOC Boundary
- ▨ Buildings
- ▨ Zone Boundary

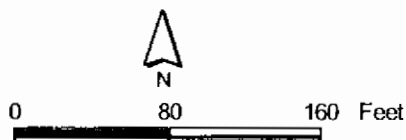
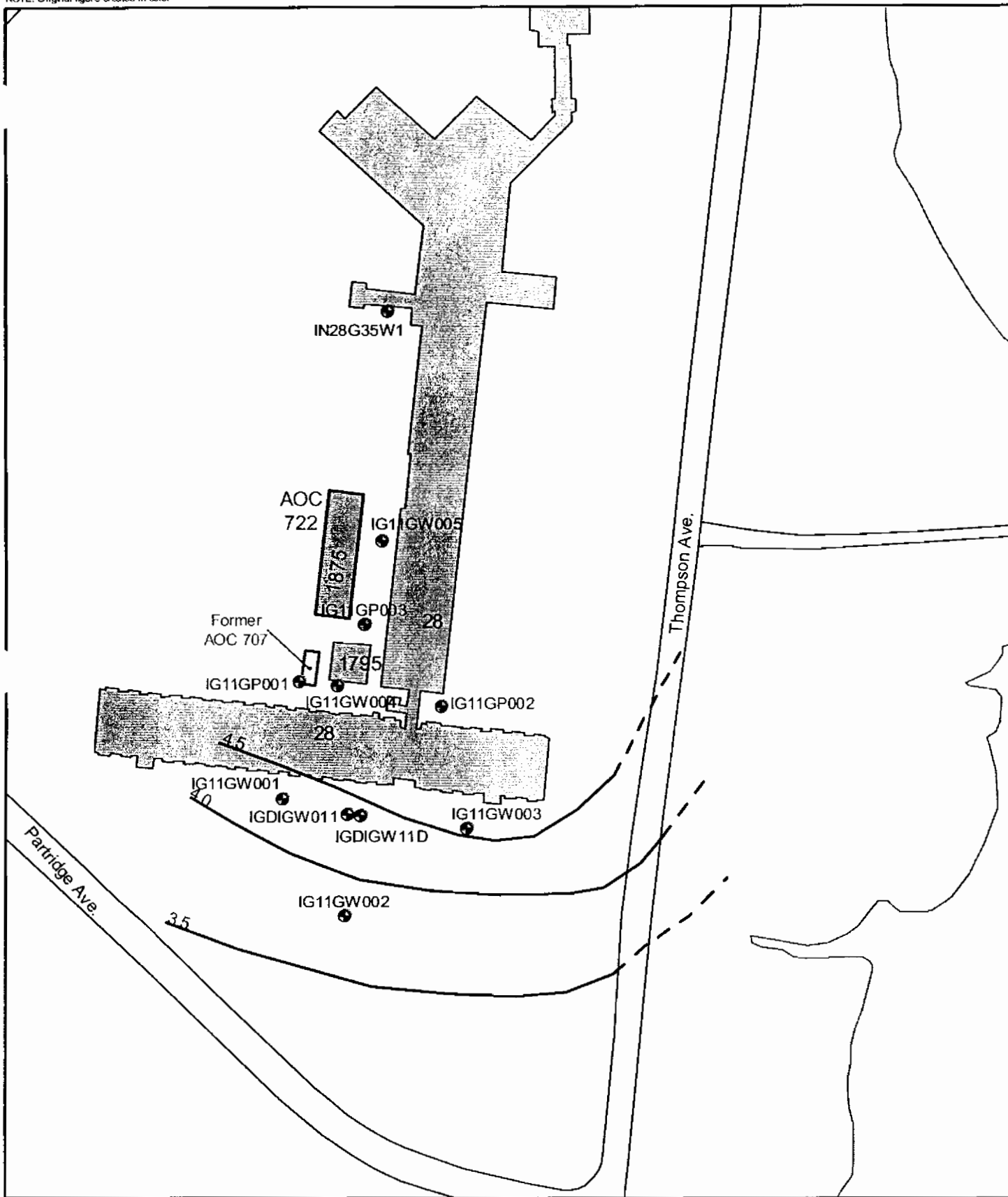


Figure 3-3
VOC Detections in Groundwater
AOC 722, Zone I
Charleston Naval Complex

CH2MHILL

NOTE: Original figure created in color



Shallow Groundwater Contours 3-7-2002

- | | |
|------------------|------------------|
| Known | AOC Boundary |
| Inferred | NFA AOC Boundary |
| Sampling Station | Buildings |
| Roads | Zone Boundary |
| Shoreline | |

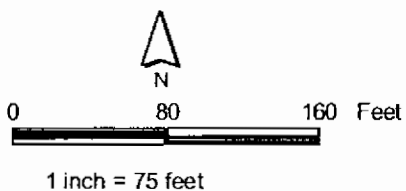
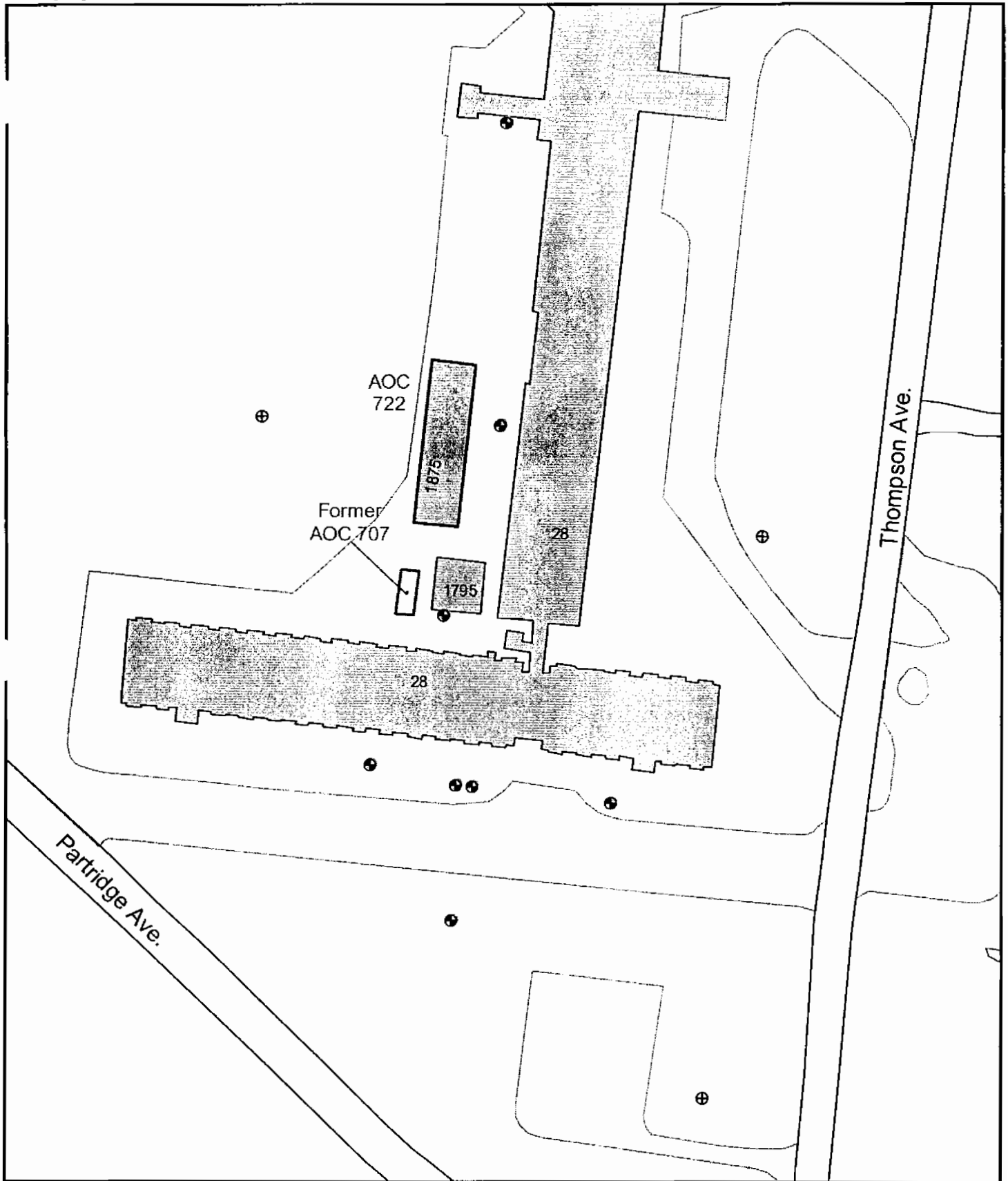


Figure 3-4
Shallow Aquifer Potentiometric Surface
AOC 722, Zone I
Charleston Naval Complex

CH2MHILL

NOTE: Original figure created in color



- Monitoring Well
- ⊕ Proposed Monitoring Well

- ▬ Roads
- ▬ Pavement
- ▬ Shoreline
- ▭ AOC Boundary
- ▭ NFA AOC Boundary
- ▨ Buildings

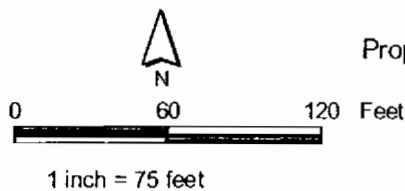


Figure 3-5
Proposed Groundwater Sampling Locations
AOC 722, Zone I
Charleston Naval Complex

CH2MHILL

1 4.0 References

- 2 CH2M-Jones, Inc., *Environmental Baseline Survey for Transfer of Phase IV Parcels, Charleston*
3 *Naval Complex*, Draft, October 2002
- 4 EnSafe Inc./Allen & Hoshall. *Final Comprehensive Sampling and Analysis Plan*. RCRA Facility
5 Investigation. July 30, 1996.
- 6 EnSafe Inc. *Zone I RFI Report, Revision 1*. July 1999.
- 7 U.S. Environmental Protection Agency (EPA). *Environmental Services Division Standard*
8 *Operating Procedures and Quality Assurance Manual*. Region IV, Environmental Services
9 Division. 1996.

Appendix A

APPENDIX A

Analytical Results for 2002 Groundwater Sampling Event

RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 722, Zone I, CNC

SAMPLE ID	STATION	CHEM_NAME	RESULT	UNIT	QUALIFIER	DATE_COL
G11GW001M1	IG11GW001	1,2-Dichlorobenzene	11.60	µg/L	=	02/22/2002
G11GW001M1	IG11GW001	1,3-Dichlorobenzene	0.60	µg/L	J	02/22/2002
G11GW001M1	IG11GW001	Chlorobenzene	6.00	µg/L	=	02/22/2002
G11GW001M1	IG11GW001	Trichloroethylene (TCE)	1.40	µg/L	J	02/22/2002
G11GW001M1	IG11GW001	Toluene	0.26	µg/L	J	02/22/2002
G11GW002M1	IG11GW002	1,2-Dichlorobenzene	31.40	µg/L	=	02/22/2002
G11GW002M1	IG11GW002	1,3-Dichlorobenzene	1.20	µg/L	J	02/22/2002
G11GW002M1	IG11GW002	1,4-Dichlorobenzene	2.90	µg/L	J	02/22/2002
G11GW002M1	IG11GW002	Benzene	1.30	µg/L	J	02/22/2002
G11GW002M1	IG11GW002	Chlorobenzene	22.00	µg/L	=	02/22/2002
G11GW002M1	IG11GW002	Trichloroethylene (TCE)	3.00	µg/L	J	02/22/2002
G11GW002M1	IG11GW002	Toluene	0.35	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	1,2-Dichlorobenzene	3.80	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	1,2-Dichloroethene (total)	0.56	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	2-Hexanone	9.20	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	Carbon Disulfide	23.00	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	Chlorobenzene	2.40	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	cis-1,2-Dichloroethylene	0.56	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	Methyl ethyl ketone (2-Butanone)	3.00	µg/L	J	02/22/2002
G11GW003M1	IG11GW003	Trichloroethylene (TCE)	0.62	µg/L	J	02/22/2002
G11GW004	IG11GW004	Bromodichloromethane	4.70	µg/L	J	05/23/2002
G11GW004	IG11GW004	Bromoform	2.40	µg/L	J	05/23/2002
G11GW004	IG11GW004	Chloroform	3.00	µg/L	J	05/23/2002
G11GW004	IG11GW004	Dibromochloromethane	5.40	µg/L	J	05/23/2002
G11GW004	IG11GW004	Trichloroethylene (TCE)	0.62	µg/L	J	05/23/2002
G11GW005M2	IG11GW005	1,2-Dichloroethene (total)	18.40	µg/L	=	05/23/2002
G11GW005M2	IG11GW005	Benzene	8.40	µg/L	=	05/23/2002
G11GW005M2	IG11GW005	Carbon Disulfide	9.10	µg/L	=	05/23/2002
G11GW005M2	IG11GW005	cis-1,2-Dichloroethylene	16.30	µg/L	=	05/23/2002
G11GW005M2	IG11GW005	Ethylbenzene	1.70	µg/L	J	05/23/2002
G11GW005M2	IG11GW005	o-Xylene	2.40	µg/L	J	05/23/2002
G11GW005M2	IG11GW005	Trichloroethylene (TCE)	72.50	µg/L	=	05/23/2002
G11GW005M2	IG11GW005	trans-1,2-Dichloroethene	2.10	µg/L	J	05/23/2002
G11GW005M2	IG11GW005	m+p Xylene	1.80	µg/L	J	05/23/2002

APPENDIX A

Analytical Results for 2002 Groundwater Sampling Event

RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 722, Zone I, CNC

SAMPLE ID	STATION	CHEM_NAME	RESULT	UNIT	QUALIFIER	DATE_COL
G11GW005M2	IG11GW005	Xylenes, Total	4.20	µg/L	J	05/23/2002
GDGW011M1	IGDIGW011	1,1-Dichloroethane	0.51	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	1,2-Dichloroethene (total)	3.20	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	1,2-Dichloropropane	0.30	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	Carbon Disulfide	66.60	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	cis-1,2-Dichloroethylene	2.20	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	Ethylbenzene	0.26	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	Trichloroethylene (TCE)	2.10	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	Toluene	0.24	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	trans-1,2-Dichloroethene	0.96	µg/L	J	02/22/2002
GDGW011M1	IGDIGW011	Vinyl chloride	0.74	µg/L	J	02/22/2002
GDGW11DM1	IGDIGW11D	Carbon Disulfide	24.70	µg/L	J	02/22/2002